What is claimed is:

Rule 1.126

1. A hammermill for reducing oversized particulates to desired sized particulates, comprising:

a housing with an inlet end for receiving oversized particulates, a discharge end for exiting desired sized particulates, and a longitudinal axis;

a grate assembly comprising a plurality of screen bars that are spaced apart a predetermined distance, the grate assembly positioned in the discharge end of the housing;

a rotor assembly disposed within the housing;

a first plurality of hammers coupled to the rotor assembly, the plurality of hammers disposed intermediate the inlet end and the discharge end of the housing;

a second plurality of hammers coupled to the rotor assembly, the second plurality of hammers disposed proximate the inlet end of the housing and adjacent the first plurality of hammers;

a third plurality of hammers coupled to the rotor assembly, the third plurality of hammers disposed proximate the discharge end of the housing and adjacent the first plurality of hammers;

a first attrition plate assembly having a generally circular configuration and secured within the housing intermediate the inlet end and the discharge end of the housing;

a second attrition plate assembly having a generally semi-circular configuration and secured within the housing adjacent the inlet end of the housing and the first attrition plate assembly,

wherein a least a portion of each hammer of the first plurality of hammers closely overlies a portion of the first attrition plate assembly, at least a portion of each hammer of the second plurality of hammers closely overlies a portion of the second attrition plate assembly, and at least a portion of each

hammer of the third plurality of hammers overlies a portion of the grate assembly so that the hammers of the first plurality of hammers cooperate with the first attrition plate assembly, the hammers of the second plurality of hammers cooperate with the second attrition plate assembly, and the hammers of the third plurality of hammers cooperate with the grate assembly to form the desired sized particulates.

2. The hammermill of Claim 1, further comprising a third attrition plate assembly having a generally semi-circular configuration and secured within the housing adjacent the discharge end of the housing and the first attrition plate assembly.

3. The hammermill of Claim 2, wherein each of the respective first, second, and third attrition plate assemblies comprises a plurality of attrition impact plates, each attrition impact plate having a curvilinear inner surface.

4. The hammermill of Claim 1, wherein each hammer of the first plurality of hammers comprises a fixed hammer.

5. The hammermill of Claim 1, wherein each hammer of the first plurality of hammers is selected from a group consisting of fixed hammers, swing hammers, or a combination thereof.

6. The hammermill of Claim 1, wherein each hammer of the second plurality of hammers comprises a swing hammer.

7. The hammermill of Claim 1, wherein each hammer of the second plurality of hammers is selected from a group consisting of fixed hammers, swing hammers, or a combination thereof.

8. The hammermill of Claim 1, wherein each hammer of the third plurality of hammers comprises a fixed hammer.

9. The hammermill of Claim 1, wherein each hammer of the third plurality of hammers is selected from a group consisting of fixed hammers, swing hammers, or a combination thereof.

10. The hammermill of Claim 1, wherein each hammer of the first, second, and third plurality of hammers has an impact end, the impact end having a proximal end, a spaced distal end, and a pair of opposing side edges extending between the proximal and distal ends, at least one of the side edges defining an impact edge extending for at least a portion of the side edge.

11. The hammermill of Claim 10, wherein the impact end of each hammer has a hammer longitudinal axis that is angled with respect to the longitudinal axis of the hammermill, at least one of the side edges of the impact end of each hammer being substantially parallel to the hammer longitudinal axis.

12. The hammermill of Claim 11, wherein each side edge of the impact end of each hammer is substantially parallel to the hammer longitudinal axis.

13. The hammermill of Claim 11, wherein the hammer longitudinal axis is angled with respect to the longitudinal axis of the hammermill about and between approximately 1 degree to 75 degrees.

14. The hammermill of Claim 11, wherein the hammer longitudinal axis is angled with respect to the longitudinal axis of the hammermill about and between approximately 1 degree to 60 degrees.

15. The hammermill of Claim 11, wherein each hammer has a connection portion constructed and arranged for coupling to a portion of the rotor assembly and a shank portion extending between the connection portion and the impact end, the shank portion having a first shank surface extending to a first shank edge and an opposing second shank surface extending to a second shank edge, the first and second shank surfaces extending between the connection portion and the impact end of each hammer, wherein the first and second shank surfaces are angled with respect to the longitudinal axis of the hammermill.

16. The hammermill of Claim 15, wherein at least one of the first shank surface and second shank surface of each hammer is parallel to the hammer longitudinal axis.

17. The hammermill of Claim 16, wherein the first and second shank surfaces are substantially co-planar.

18. The hammermill of Claim 15, wherein a portion of the first shank surface adjoining a portion of the impact edge and a portion of the first shank edge defines a first male protrusion extending from the portion of the first shank surface.

19. The hammermill of Claim 18, wherein a portion of the second shank surface adjoining a portion of the impact edge and a portion of the second shank edge defines a second male protrusion extending from the portion of the second shank surface.

20. The hammermill of Claim 10, wherein the impact end of each hammer has a bottom surface extending between the side edges of the impact end, at least a portion of the bottom surface defining a convex shape.

21. The hammermill of Claim 2, wherein each of the respective first, second, and third attrition plate assemblies comprise a plurality of attrition impact plates, and wherein each attrition impact plate has a curvilinear inner surface.

22. The hammermill of Claim 21, wherein at least two attrition impact plates are positioned so that the curvilinear inner surface of the attrition impact plates form a substantially continuous work surface within a portion of the housing, and wherein the continuous work surface has a generally cylindrical shape and encloses the first plurality of hammers.

23. The hammermill of Claim 21, wherein the inner surface of each attrition impact plate defines at least one male protrusion extending from the inner surface, each male protrusion defining a geometric shape.

24. The hammermill of Claim 21, wherein the inner surface of each attrition impact plate defines at least one female depression in the inner surface, each female depression protrusion having a geometric shape.

25. The hammermill of Claim 1, wherein each screen bar of the plurality of screen bars extends substantially parallel to the longitudinal axis of the housing.

26. The hammermill of Claim 1, wherein each hammer of the first, second, and third plurality of hammers has an outer tip which defines a hammer rotation radius about the longitudinal axis of the housing, each hammer also having a connection portion constructed and arranged for coupling to a portion of the rotor assembly, further comprising at least one annular ring having an peripheral ring edge, one annular ring of the at least one annular ring connected to the rotor assembly adjacent a portion of the connection portion of

at least one hammer of the first, second, and third plurality of hammers such that the peripheral ring edge of the annular ring extends outwardly from the rotor assembly toward the sidewall of the housing, wherein the peripheral ring edge defines a maximum radius of curvature about the longitudinal axis of the housing that is about or less than the hammer rotation radius.

27. The hammermill of Claim 26, wherein the annular ring is positioned upstream of the at least one hammer.

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~~28~~. The hammermill of Claim 26, further comprising at least one annular spacer member,
wherein one annular spacer member or one annular ring is connected to the rotor assembly adjacent each hammer of the first, second, and third plurality of hammers.

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~~30~~. A hammermill comprising:

a housing having an inlet end, a discharge end, a sidewall extending between the inlet end and the discharge end, and a longitudinal axis, the sidewall of the housing defining an enclosed work space, an inlet opening being defined in the sidewall of the housing proximate the inlet end of the housing, a discharge opening being defined in the sidewall of the housing proximate the discharge end of the housing, the inlet opening being disposed above the longitudinal axis of the housing and the discharge opening being disposed below the longitudinal axis of the housing;

a rotor assembly disposed within the housing for rotation about the longitudinal axis of the housing;

a first plurality of hammers coupled to the rotor assembly and disposed in the enclosed work space;

a second plurality of hammers coupled to the rotor assembly, the second plurality of hammers disposed proximate the inlet end of the housing and adjacent the first plurality of hammers; and

at least one annular ring having an peripheral ring edge,

wherein each hammer of the first and second plurality of hammers has an outer tip which defines a hammer rotation radius about the longitudinal axis of the housing, each hammer also having a connection portion constructed and arranged for coupling to a portion of the rotor assembly, and wherein one annular ring of the at least one annular ring is connected to the rotor assembly adjacent a portion of the connection portion of at least one hammer of the first and second plurality of hammers such that the peripheral ring edge of the annular ring extends outwardly from the rotor assembly toward the sidewall of the housing, wherein the peripheral ring edge defines a maximum radius of curvature about the longitudinal axis of the housing that is about or less than the hammer rotation radius.

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31. The hammermill of Claim 30, wherein the annular ring is positioned upstream of the at least one hammer.

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32. The hammermill of Claim 30, further comprising at least one annular spacer member, wherein one annular spacer member or one annular ring is connected to the rotor assembly adjacent each hammer of the first and second plurality of hammers.

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33. The hammermill of Claim 30, further comprising a third plurality of hammers coupled to the rotor assembly, the third plurality of hammers disposed proximate the discharge end of the housing and adjacent the first plurality of hammers.

34. The hammermill of Claim 33, wherein one annular ring of the at least one annular ring is connected to the rotor assembly adjacent a portion of the connection portion of at least one hammer of the first, second, and third plurality of hammers.

35. The hammermill of Claim 34, wherein the annular ring is positioned upstream side of the at least one hammer.

36. The hammermill of Claim 34, further comprising at least one annular spacer member,

wherein one annular spacer member or one annular ring is connected to the rotor assembly adjacent each hammer of the first, second, and third plurality of hammers.

37. The hammermill of Claim 30, further comprising a first attrition plate assembly having a generally circular configuration secured to the sidewall within the enclosed work space of the housing, the first attrition plate assembly arranged such that at least a portion of each hammer of the first plurality of hammers is spaced from and overlies a portion of the first attrition plate assembly, wherein the first attrition plate assembly defines a substantially continuous first work surface in the enclosed work space.

38. The hammermill of Claim 37, further comprising a second attrition plate assembly having a generally semi-circular configuration and secured within the housing adjacent the first attrition plate assembly and the inlet opening of the housing, wherein at least a portion of each hammer of the second plurality of hammers is spaced from and overlies a portion of the second attrition plate assembly.

38. The hammermill of Claim 33, further comprising a third attrition plate assembly having a generally semi-circular configuration and secured within the housing adjacent the discharge end of the housing and the first attrition plate assembly.

39. The hammermill of Claim 30, wherein at least a portion of the second plurality of hammers underlies the inlet opening.

40. The hammermill of Claim 33, further comprising a grate assembly disposed in the discharge end of the housing, wherein at least a portion of each hammer of the third plurality of hammers overlies a portion of the grate assembly.

41. The hammermill of Claim 41, wherein the grate assembly comprises a plurality of screen bars, each screen bar of the plurality of screen bars extending substantially parallel to the longitudinal axis of the housing.

42. The hammermill of Claim 42, wherein the plurality of screen bars are spaced apart a predetermined distance.

43. A hammer for coupling to a rotor assembly that is rotatable about a longitudinal axis of a hammermill, comprising:

an impact end, the impact end having a proximal end, a spaced distal end, and a pair of opposing side edges extending between the proximal and distal ends, at least one of the side edges defining an impact edge extending for at least a portion of the side edge;

a connection portion constructed and arranged for coupling to a portion of the rotor assembly; and

a shank portion extending between the impact end and the connection portion, the shank portion having a first shank surface extending to a first

shank edge and a second shank surface extending to a second shank edge, the first and second shank edges extending between the connection portion and the impact end;

wherein the impact end has a hammer longitudinal axis that is angled with respect to the longitudinal axis of the hammermill, at least one of the side edges of the impact end being substantially parallel to the hammer longitudinal axis.

45. The hammer of Claim 44, wherein each side edge of the impact end is substantially parallel to the hammer longitudinal axis.

46. The hammer of Claim 44, wherein the hammer longitudinal axis is angled with respect to the longitudinal axis of the hammermill about and between approximately 1 degree to 75 degrees.

47. The hammer of Claim 44, wherein the hammer longitudinal axis is angled with respect to the longitudinal axis of the hammermill about and between approximately 1 degree to 60 degrees.

48. The hammer of Claim 44, wherein the first and second shank surfaces are angled with respect to the longitudinal axis of the hammermill.

49. The hammer of Claim 48, wherein at least one of the first shank surface and second shank surface is parallel to the hammer longitudinal axis.

50. The hammer of Claim 49, wherein the first and second shank surfaces are substantially co-planar.

51. The hammer of Claim 48, wherein a portion of the first shank surface that adjoins a portion of the impact edge and a portion of the first shank edge

defines a first male protrusion extending from the portion of the first shank surface.

52. The hammer of Claim 51, wherein a portion of the second shank surface that adjoins a portion of the impact edge and a portion of the second shank edge defines a second male protrusion extending from the portion of the second shank surface.

53. The hammer of Claim 44, wherein the impact end has a bottom surface extending between the side edges of the impact end, at least a portion of the bottom surface defining a convex shape.

54. The hammer of Claim 44, wherein the connection portion defines at least one bore extending therethrough that is constructed and arranged for coupling to a portion of the rotor assembly.

55. A hammermill comprising:

a housing having an inlet end, a discharge end, a sidewall extending between the inlet end and the discharge end, a longitudinal axis, a primary reduction chamber, a secondary reduction chamber adjoining the primary reduction chamber, and a tertiary reduction chamber adjoining the secondary reduction chamber, the sidewall proximate the inlet end of the housing defines an inlet opening, wherein, in the secondary reduction chamber, the sidewall of the housing defining an enclosed work space, wherein, in the primary reduction chamber, the sidewall and the inlet opening define a first partially enclosed work space, and wherein, in the tertiary reduction chamber, the sidewall and the discharge opening define a second partially enclosed work space;

a grate assembly positioned in the discharge end of the housing;

a rotor assembly disposed within the housing for rotation about the longitudinal axis of the housing;

a plurality of hammers coupled to the rotor assembly and disposed in the primary, secondary, and tertiary reduction chambers, respectively, each hammer of the plurality of hammers having an impact end, the impact end having a hammer longitudinal axis, a proximal end, a spaced distal end, and a pair of opposing side edges extending between the proximal and distal ends, the hammer longitudinal axis of each impact end being angled with respect to the longitudinal axis of the housing, at least one of the side edges of the impact end of each hammer being substantially parallel to the hammer longitudinal axis; and

an attrition plate assembly secured to the sidewall within the primary and secondary reduction chambers, respectively, the attrition plate assembly arranged such that the hammers disposed in the primary and secondary reduction chambers are spaced from and overlie a portion of the attrition plate assembly;

wherein a portion of each hammer disposed in the tertiary reduction chamber is spaced from and overlies a portion of the grate assembly.

58. A hammermill comprising:

a housing having an inlet end, a discharge end, a sidewall extending between the inlet end and the discharge end, a longitudinal axis, a primary reduction chamber, and a secondary reduction chamber adjoining the primary reduction chamber, the sidewall proximate the inlet end of the housing defining an inlet opening, wherein, in the secondary reduction chamber, the sidewall of the housing defining an enclosed work space, wherein, in the primary reduction chamber, the sidewall and the inlet opening define a partially enclosed work space;

a rotor assembly disposed within the housing for rotation about the longitudinal axis of the housing;

a plurality of hammers coupled to the rotor assembly and disposed in the primary and secondary reduction chambers, respectively, each hammer of the plurality of hammers comprising:

an impact end, the impact end having a proximal end, a spaced distal end, and a pair of opposing side edges extending between the proximal and distal ends, at least one of the side edges defining an impact edge extending for at least a portion of the side edge, wherein the impact end has a hammer longitudinal axis that is angled with respect to the longitudinal axis of the hammermill, at least one of the side edges of the impact end being substantially parallel to the hammer longitudinal axis;

a connection portion constructed and arranged for coupling to a portion of the rotor assembly; and

a shank portion extending between the impact end and the connection portion, the shank portion having a first shank surface extending to a first shank edge and a second shank surface extending to a second shank edge, the first and second shank edges extending between the connection portion and the impact end, wherein the first and second shank surfaces are angled with respect to the longitudinal axis of the hammermill; and

an attrition plate assembly secured to the sidewall within the primary and secondary reduction chambers, respectively, the attrition plate assembly arranged such that the hammers disposed in the primary and secondary reduction chambers are spaced from and overlie a portion of the attrition plate assembly.

57. A hammermill comprising:

a housing having an inlet end, a discharge end, a sidewall extending between the inlet end and the discharge end, a longitudinal axis, a primary reduction chamber and an adjoining secondary reduction chamber, the

sidewall proximate the inlet end of the housing defining an inlet opening, wherein, in the secondary reduction chamber, the sidewall of the housing defining an enclosed work space, and wherein, in the primary reduction chamber, the sidewall and the inlet opening define a partially enclosed work space;

a rotor assembly disposed within the housing for rotation about the longitudinal axis of the housing;

a plurality of hammers coupled to the rotor assembly and disposed in both the primary and secondary reduction chambers, respectively, wherein each hammer of the plurality of hammers has an outer tip which defines a hammer rotation radius about the longitudinal axis of the housing, each hammer also having a connection portion constructed and arranged for coupling to a portion of the rotor assembly, wherein each hammer of the plurality of hammers is selected from a group consisting of fixed hammers, swing hammers, or a combination thereof; and

an attrition plate assembly secured to the sidewall within the primary and secondary reduction chambers, respectively, the attrition plate assembly arranged such that the hammers are spaced from and overlie a portion of the attrition plate assembly;

at least one annular ring having an peripheral ring edge, wherein one annular ring of the at least one annular ring is connected to the rotor assembly adjacent a portion of the connection portion of at least one hammer of the plurality of hammers such that the peripheral ring edge of the annular ring extends outwardly from the rotor assembly toward the sidewall of the housing, and wherein the peripheral ring edge defines a maximum radius of curvature about the longitudinal axis of the housing that is about or less than the hammer rotation radius.

56. The hammermill of Claim 57, wherein the annular ring is positioned upstream of the at least one hammer.

58. The hammermill of Claim 57, further comprising at least one annular spacer member, wherein one annular spacer member or one annular ring is connected to the rotor assembly adjacent each hammer of the plurality of hammers.